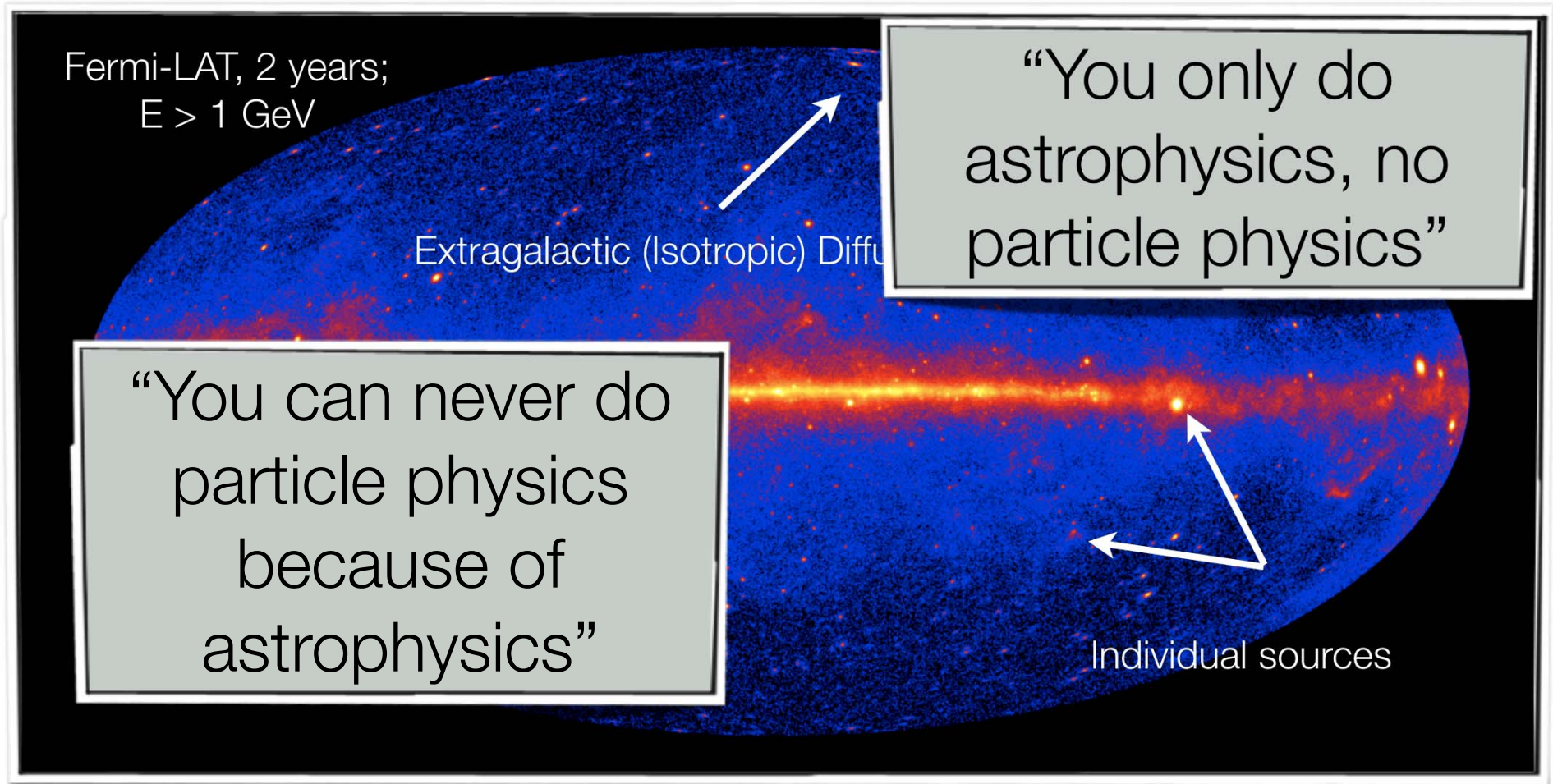
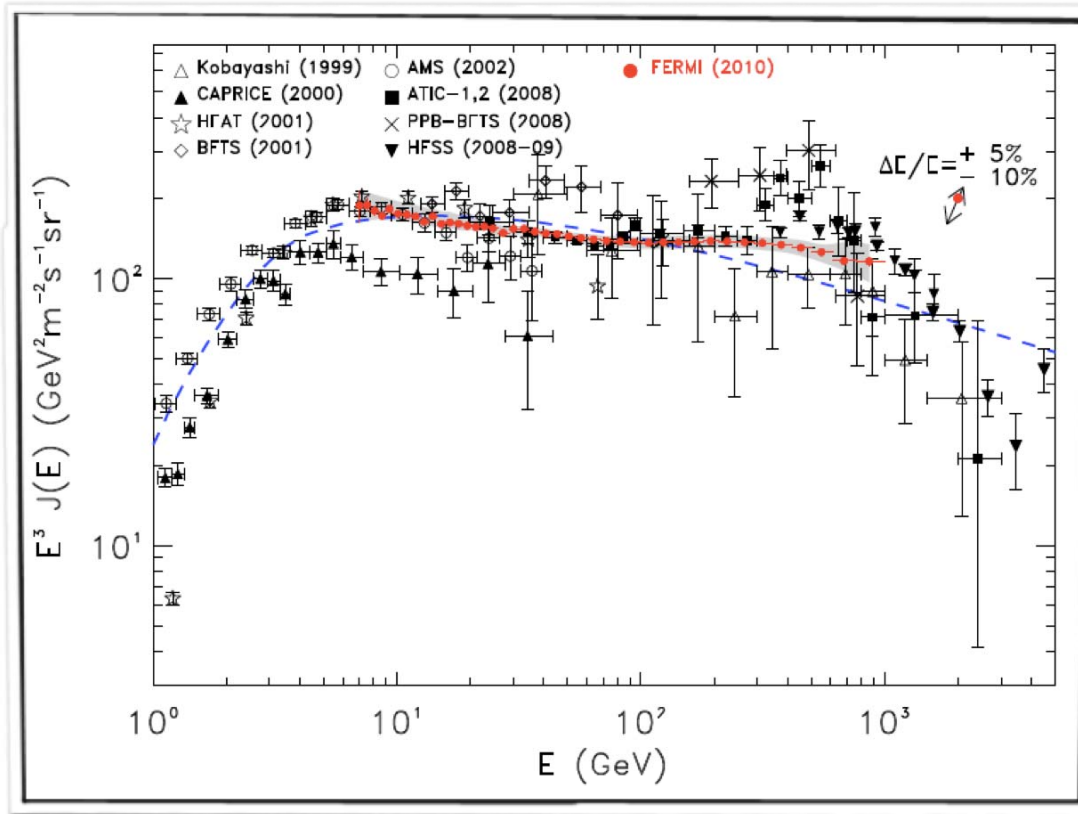


Are we doing particle physics or astrophysics?

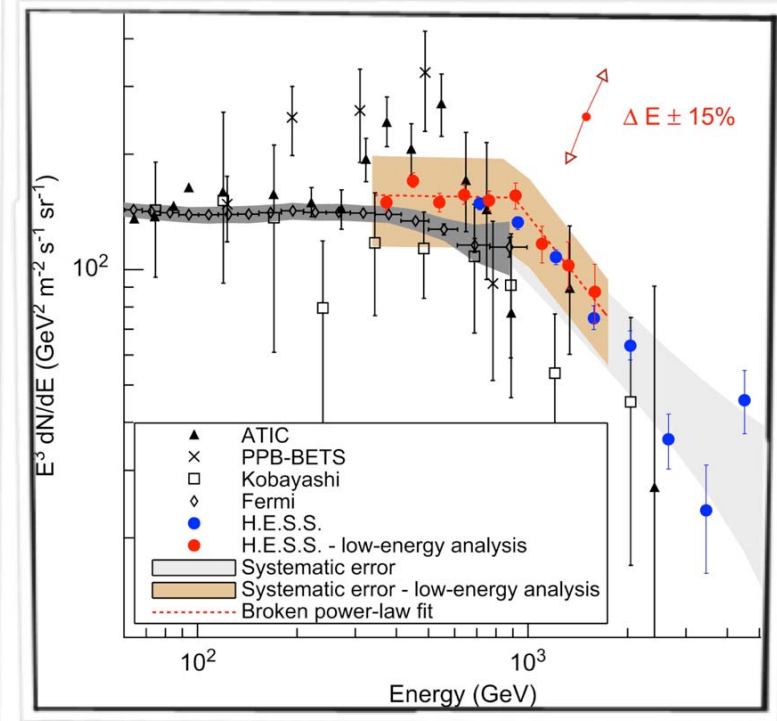


The highest-cited paper: Cosmic Ray Electrons

Fermi-LAT

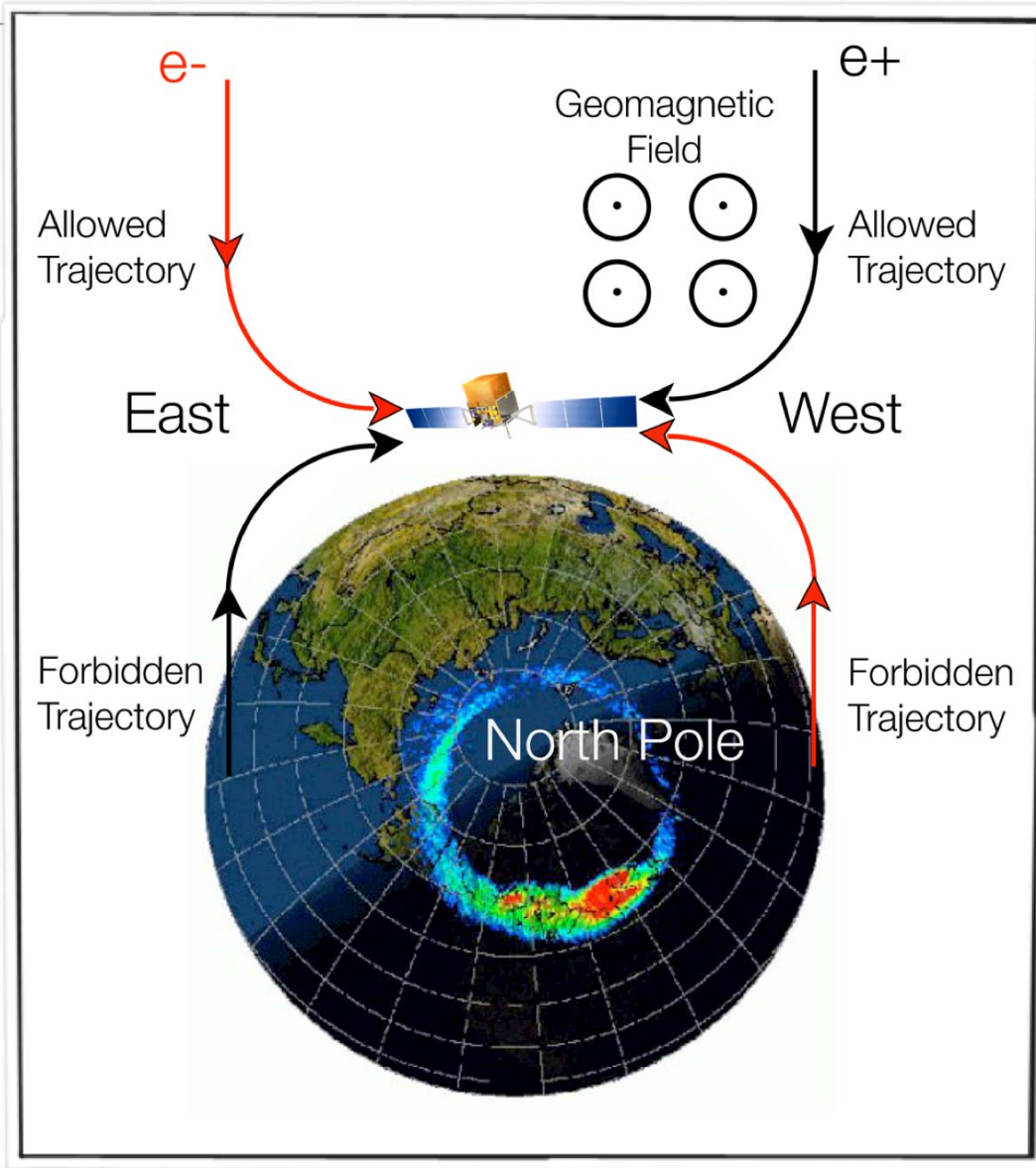


H.E.S.S.

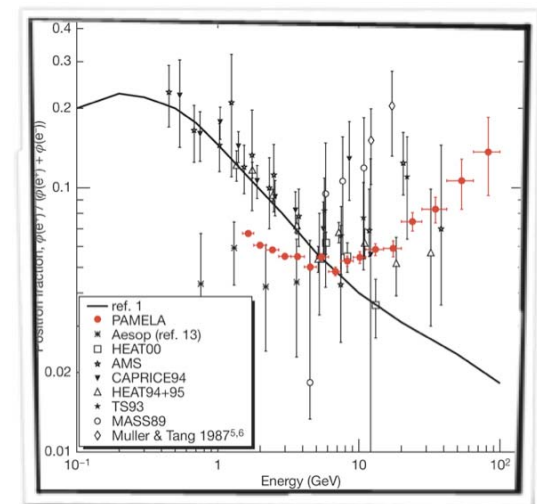


- Possibility to detect DM signatures not only in the gamma-rays but also in charged particles

... Next step: Electron/Positron separation

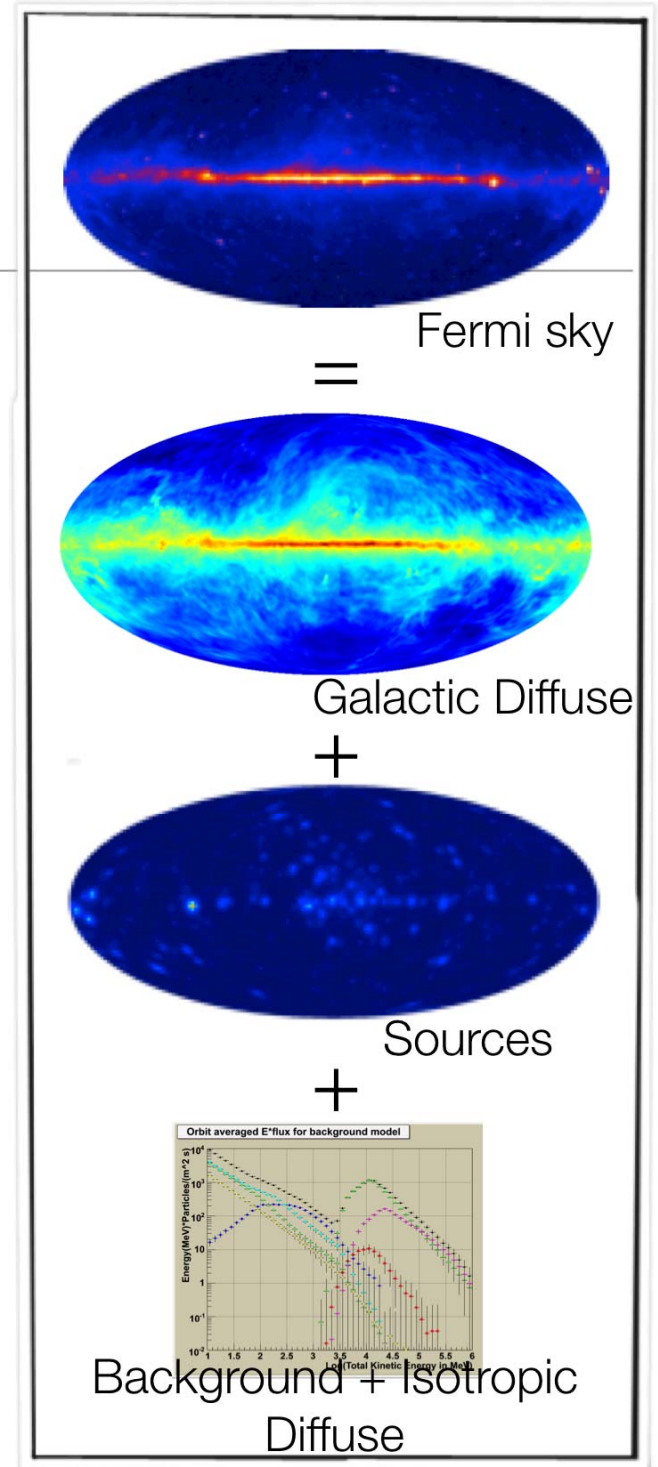
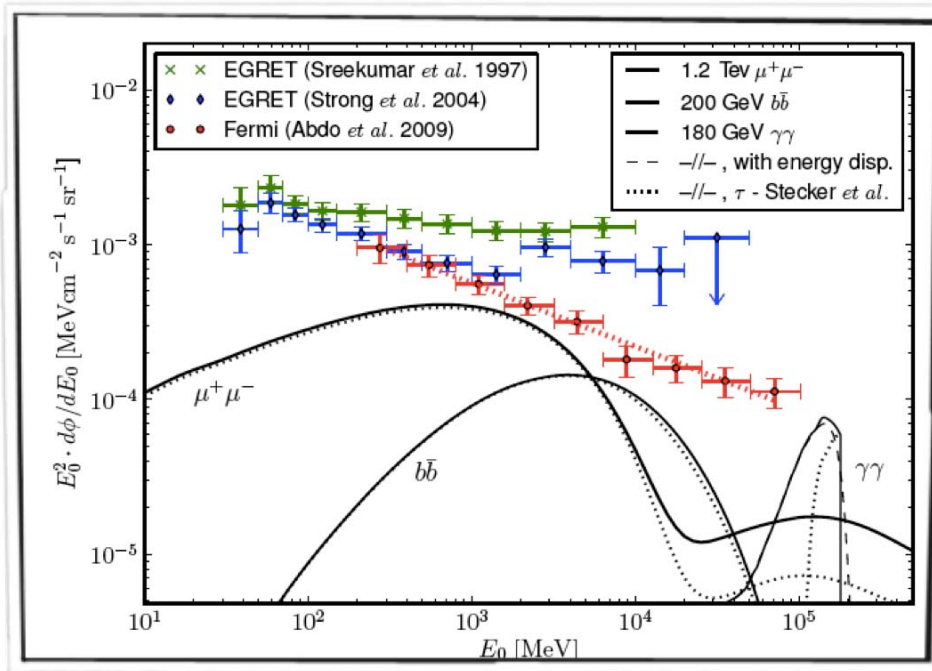


PAMELA, Nature 458, 607 (2009)



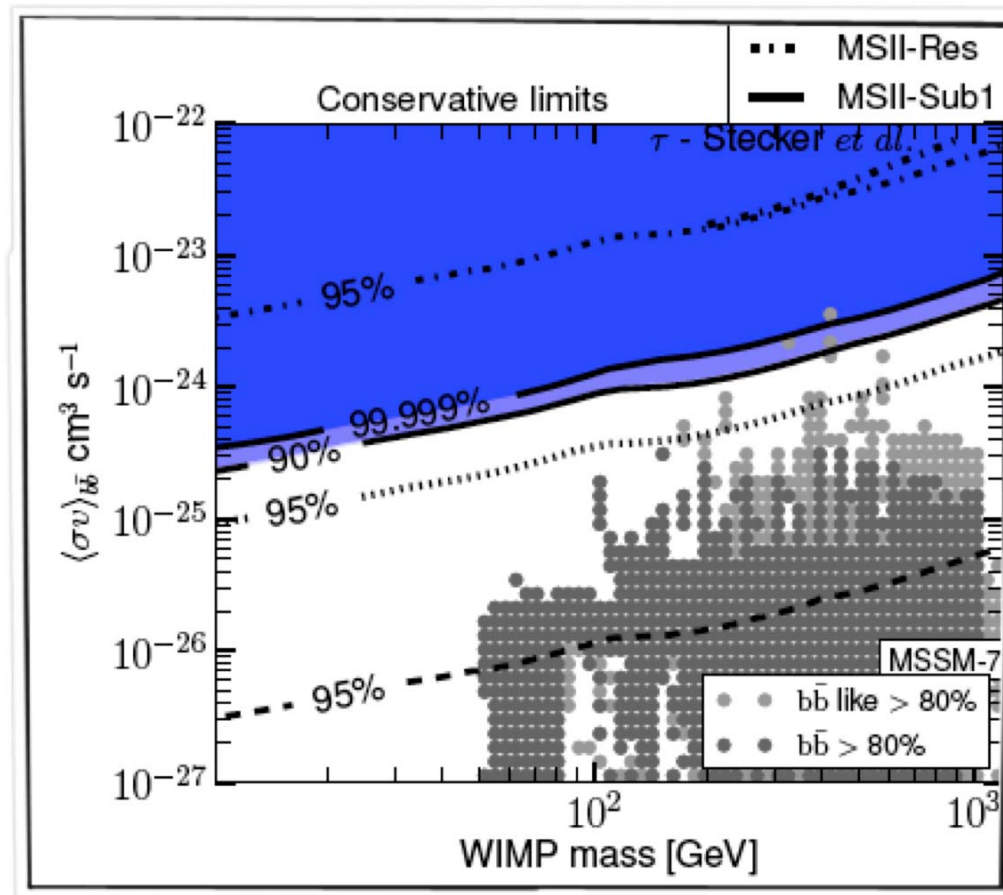
Extragalactic diffuse emission

- Contains contribution from sub-threshold sources
- Global fit (Galactic diffuse, sources, isotropic)
- Softer than previously thought (smaller contribution to electron spectrum at TeV energies) consistent with differences between LAT and EGRET seen for other objects



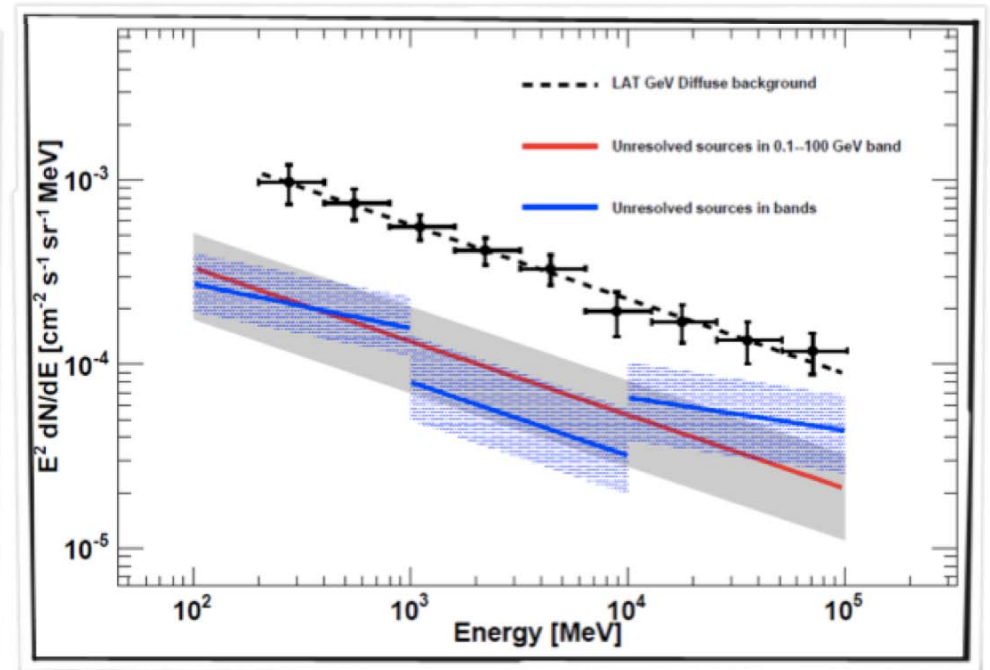
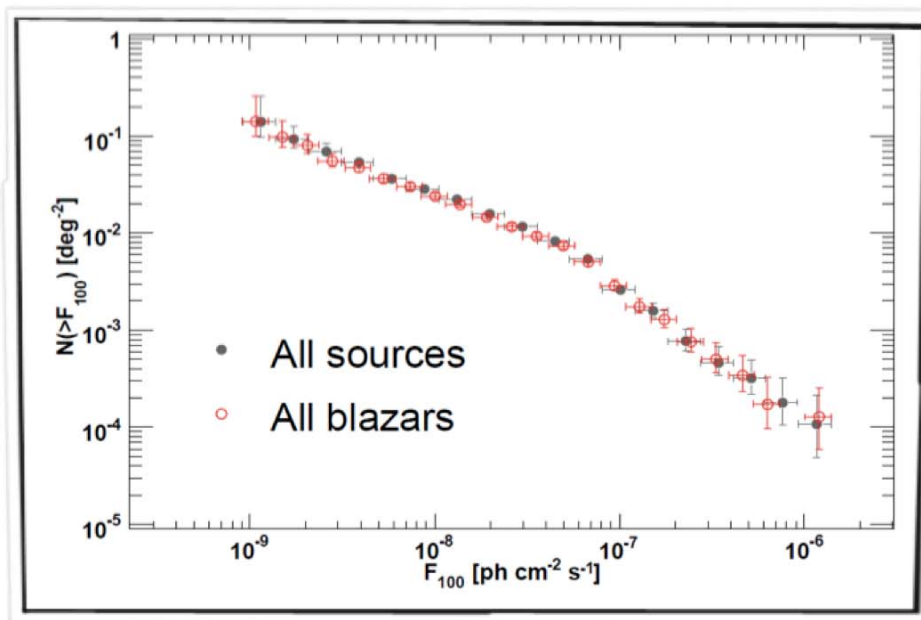
Extragalactic diffuse emission

- Case A: be completely agnostic about the Fermi-LAT sky and assume that all of the extragalactic diffuse emission is generated by DM annihilation (i.e. only require that the DM annihilation channel is below the measurement)



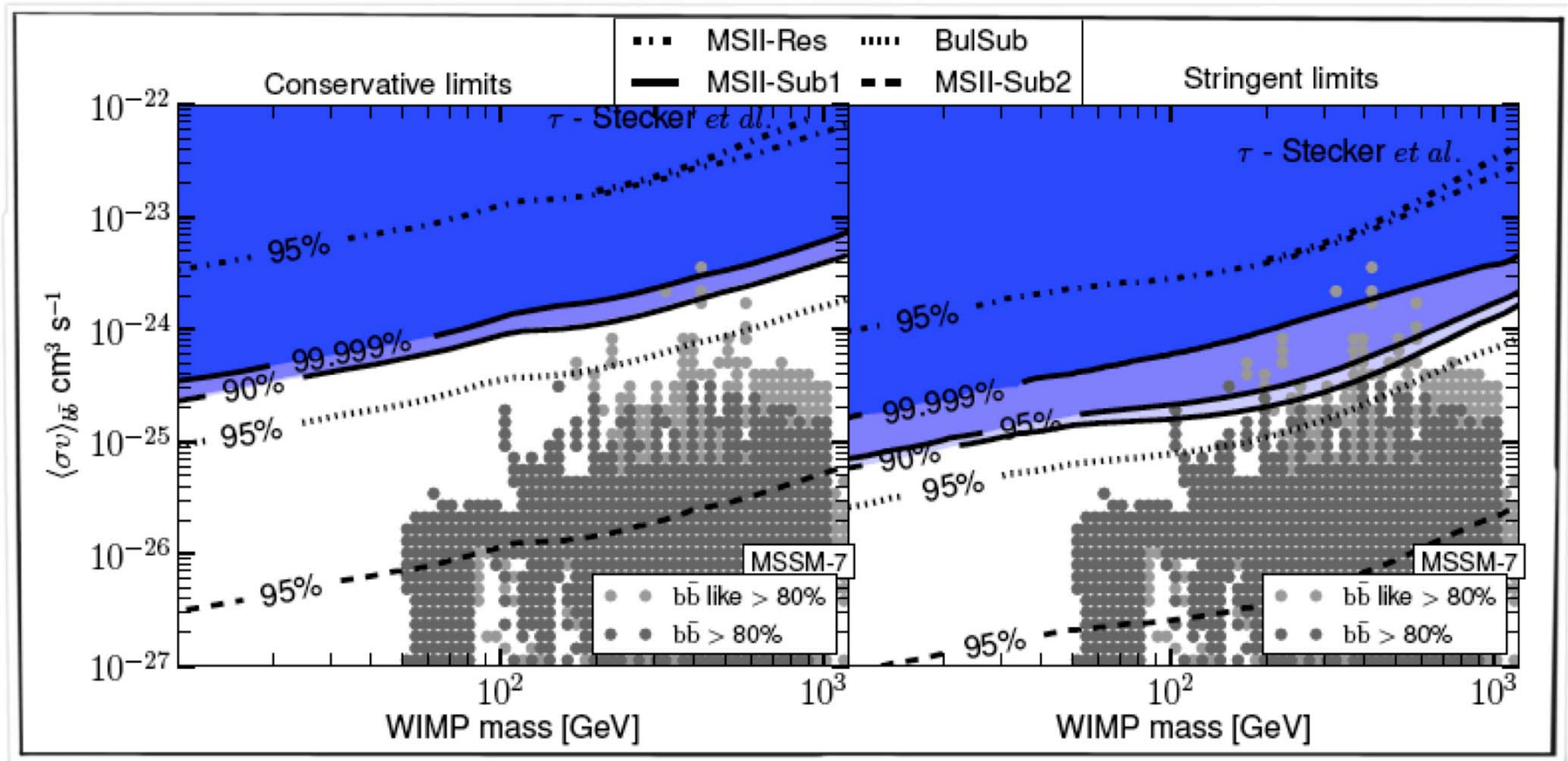
Extragalactic diffuse emission

- Case B: can do better ... Know that the dominant source of gamma-rays at high latitudes are AGN. Extrapolate distribution of sources (number of sources per flux bin or LogN-LogS) to below flux threshold values ...
 - Explains ~30% of extragalactic diffuse
- Additional contributions: starforming Galaxies, GRBs, Dark Matter, ...



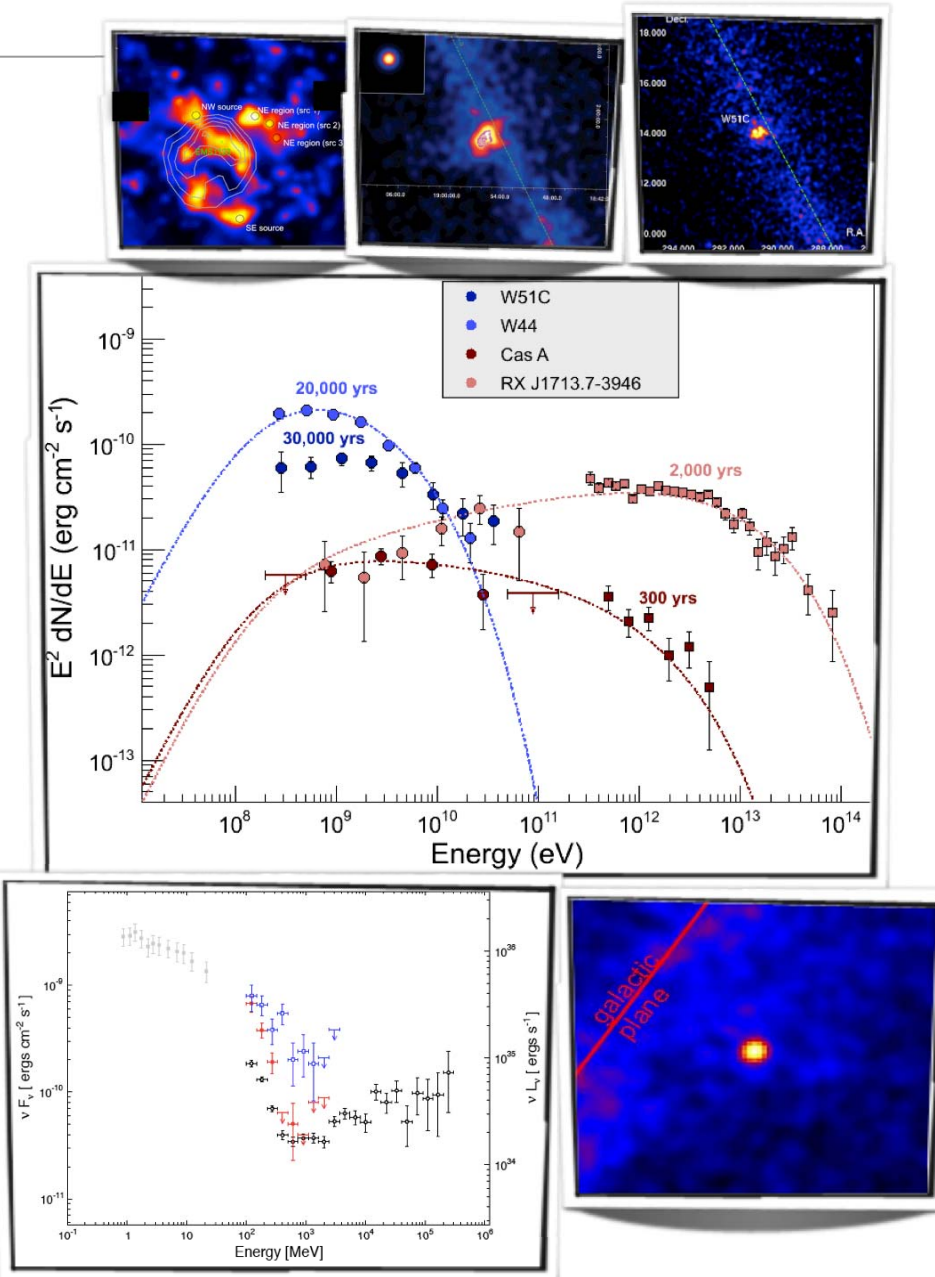
Extragalactic diffuse emission

- Case B: explain significant fraction of extragalactic diffuse by the knowledge of the Fermi-LAT sky. That way the allowed flux that can be attributed to DM shrinks ... And correspondingly, the DM limits significantly improve



Understand acceleration in cosmic sources

- Gamma-rays (and Neutrinos) provide a unique channel for understanding proton (cosmic-ray) acceleration
- Holy grail: Origin of Galactic Cosmic rays
- See clear evidence for the evolution of accelerated particles with evolution of the shock
- PeV electrons in the Crab Nebula!



The next step: CTA

- Merger of the “big three”, H.E.S.S., MAGIC, VERITAS + many others
- Currently ~600 physicists involved
- Europeans are strongest participant in terms of numbers. US, Germany, France largest single countries.
- Price tag: ~400 M\$, Astro2010 suggests a 100M\$ contribution split between three agencies

Participating Institutes:

(status May 2010)

Argentina: Instituto de Astronomía y Física del Espacio, Buenos Aires; Centro de Investigaciones en Láseres y Aplicaciones, Buenos Aires; UID GEMA - Aeronáutica, La Plata; Instituto Argentino de Radioastronomía, La Plata; Laboratorio Pierre Auger, UTN Facultad Regional, Mendoza; Centro Atómico, San Carlos de Bariloche; Instituto de Tecnologías en Detección y Astropartículas, San Martín

Armenia: Yerevan Physics Institute, Yerevan

Austria: Leopold-Franzens-Universität, Innsbruck

Bulgaria: Laboratory of Particle and Astroparticle Physics, INRNE, BAS, Sofia; Institute of Astronomy, BAS, Sofia; Sofia University

Croatia: University of Rijeka; FESB-University of Split; Rudjer Boskovic Institute, Zagreb

Czech Republic: Charles University, Prag

Finland: University of Turku/Tuorla Observatory

France: Université de Savoie, LAPP, Annecy; Université Joseph Fourier, Grenoble; Université de Montpellier 2; Université Denis Diderot, APC, Paris; Ecole Polytechnique, Paris; Université Pierre et Marie Curie, Paris; Observatoire de Paris; CEA-IRFU Saclay; Université Paul Sabatier de Toulouse

Germany: Humboldt-Universität Berlin; Ruhr-Universität Bochum; Technische Universität Dortmund; Friedrich-Alexander-Universität Erlangen-Nürnberg; Universität Hamburg; MPI für Kernphysik, Heidelberg; Landessternwarte Heidelberg; MPI für Physik, München; Universität Potsdam; Universität Tübingen; Universität Würzburg; DESY Zeuthen

Greece: National & Kapodistrian University, Athens; National Technical University of Athens; Aristotle University, Thessaloniki

Ireland: Dublin Institute for Advanced Studies

Italy: INAF, Osservatorio di Brera; INAF, Osservatorio di Bologna; INAF, Osservatorio di Catania; INAF, IASF-Palermo; INAF, Osservatorio di Padova; INAF, IASF-Roma; INAF, Osservatorio di Roma; INAF, IFSI-Torino; INAF, Telescopio Nazionale Galileo; Università degli Studi di Padova; Università degli Studi di Siena and INFN; Università di Udine and INFN Udine

Japan: ICRR University of Tokyo; University of Tokyo; Tokyo University of Science; Tokyo Institute of Technology; Aoyama-Gakuin University; Hiroshima University; Ibaraki University; Ibaraki Prefectural University; Japan Aerospace Exploration Agency, Kanagawa; KEK, Tsukuba; Kitasato University; Kyoto University; University of Miyazaki; Saitama University; Tokai University; Yamagata University; Yamanashi Gakuin University

Namibia: University of Namibia, Windhoek

Netherlands: University of Amsterdam; University of Utrecht

Poland: Institute for Nuclear Physics, Polish Academy of Sciences, Kraków; Jagiellonian University, Kraków; University of Łódź; Nicolaus Copernicus University, Toruń; Copernicus Astronomical Centre, Polish Academy of Sciences, Warszawa; Space Research Centre, Polish Academy of Sciences, Warszawa; University of Warsaw

South Africa: North-West University, Potchefstroom

Spain: IFAE Barcelona; Institut de Ciències de l'Espai, Barcelona; Universitat Autònoma de Barcelona; Universitat de Barcelona; Universidad Complutense de Madrid; CIEMAT, Madrid; Instituto de Astrofísica de Canarias, Tenerife

Sweden: Lund University; Royal Institute of Technology, Stockholm; Stockholm University;

Switzerland: University Geneva; EPF Lausanne Universität Zürich; ETH Zürich;

United Kingdom: Durham University; University of Edinburgh; University of Hertfordshire; University of Leeds; University of Leicester; University of Liverpool; University of Northumbria; University of Nottingham; University of Oxford; University of Sheffield; University of Southampton; Rutherford Appleton Laboratory, STFC

USA: Argonne National Lab; University of California Davis

In spring 2010, the following institutions joined the CTA Consortium:

Brazil: Universidade de São Paulo; Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro; Universidade Federal do Rio de Janeiro

France: CPPM, Marseille

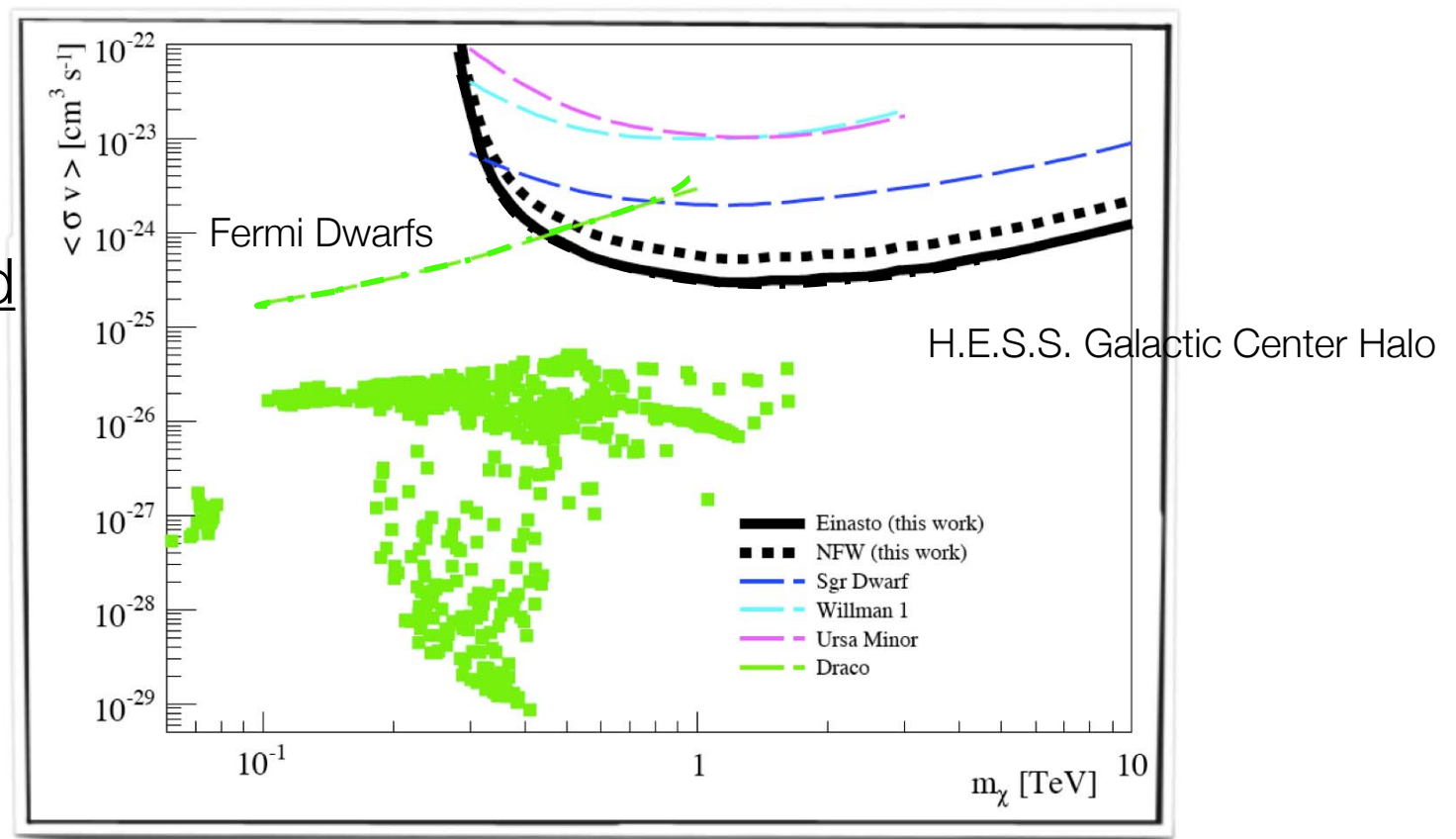
India: Bhabha Atomic Research Centre, Mumbai; Tata Institute of Fundamental Research, Mumbai; Indian Institute of Astrophysics, Bangalore; Saha Institute of Nuclear Physics, Kolkata

Slovenia: University of Nova Gorica

USA: Adler Planetarium, Chicago; Barnard College and Columbia University; Iowa State University; Ohio University; Penn State University; Pittsburg State University; Purdue University; Smithsonian Astrophysical Observatory; Stanford Linear Accelerator Center; Stanford University; University of Alabama Huntsville University of California, Los Angeles; University of California, Santa Cruz; University of Chicago; University of Delaware/Bartol Research Institute; University of Iowa; University of Minnesota; University of Utah; Washington University, St. Louis; Yale University

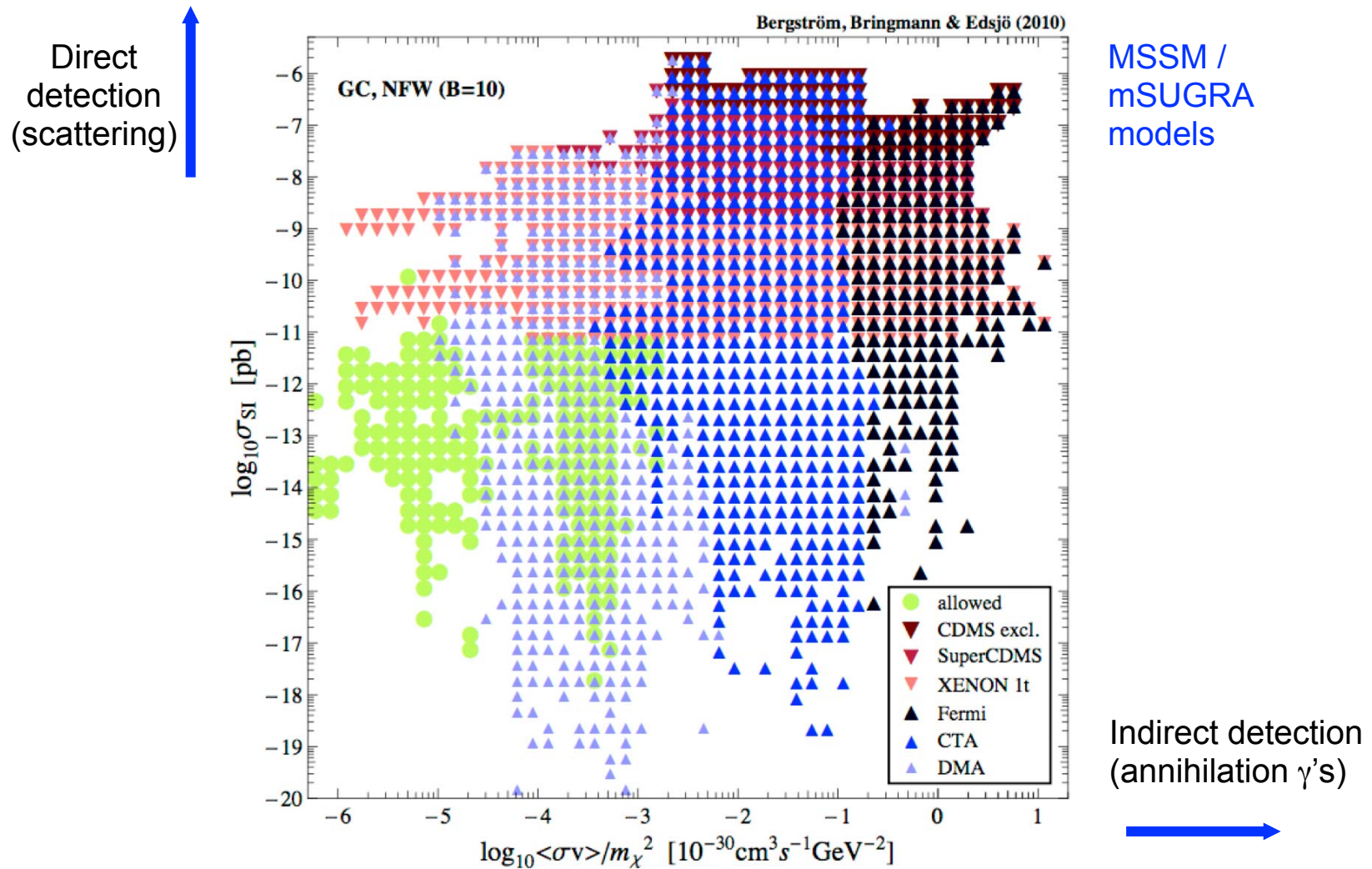
Without boost CTA/Fermi 10-years will touch MSSM models

No boost
factor assumed



Abramowski et al, 2011, astro-ph/1103.3266

Complementarity direct and indirect detection methods



Are we doing particle physics or astrophysics?

- Even if solely interested in particle physics problems (e.g. DM), astrophysical foregrounds have to be taken into account to get optimum out of the instrument
- ... And on the way, guaranteed science on the most energetic events in our Universe!
 - Particle acceleration in shocks
 - Relativistic outflows
 - ...
- Very fruitful collaboration between particle physicists and astrophysicists

